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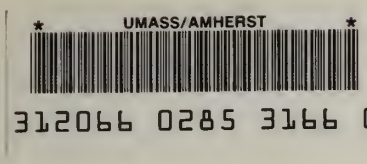

SETTING PRIORITIES AMONG TRANSPORTATION PROJECTS FOR THE METROPOLITAN PLANNING ORGANIZATION

A Study Prepared by the Metropolitan Area Planning Council

FINAL DRAFT

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PREFACE

Nationwide, significant reductions in the availability of funding for transportation improvements, compounded by dramatic increases in transportation improvement needs for all modes, have resulted in a need for a comprehensive and systematic procedure for developing priorities among transportation improvement projects. Many states and regional Metropolitan Planning Organizations (MPOs) have in recent years described the criteria with which they assign priorities to projects within their transportation improvement programs, but in Massachusetts these criteria remain undocumented.

The Executive Committee of MAPC has taken the position that an objective procedure for prioritizing the projects listed in the Transportation Improvement Program (TIP) should be established. The development and application of a project priority-setting procedure is recommended to provide decision-makers with the necessary information to assist in programming and funding projects. In no way is it intended to usurp any of the authority or responsibilities granted by law.

This study is limited in that it deals only with the highway element of the TIP. While the transit element is equally important and in need of priority-setting, the procedures, agencies and interest groups involved are very different from those for roadway projects. Transit will be addressed at a later date in a separate document.

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INTRODUCTION

The TIP is the document which lists the highway and public transportation projects expected to be candidates for federal funding over the next five fiscal years. Federal regulations require that a TIP be prepared for each urban area and adopted by the area's MPO.

In the MAPC region, the TIP is prepared by the Central Transportation Planning Staff in cooperation with the Massachusetts Department of Public Works (MDPW) and the Massachusetts Bay Transportation Authority. It is then submitted to the MPO agencies. MAPC relays the draft TIP to each of its communities for comment. The TIP beomes effective at the beginning of the federal fiscal year (October 1); it is amended twice annually to reflect changes in project status or funding.

The TIP is not a list of projects for which federal funding is guaranteed. There are thirteen separate categories, each containing federal and state funds. The TIP simply identifies projects eligible for funding by virtue of being consistent with the Transportation Plan of the Metropolitan Planning Organization. In recent years, declining federal funding has meant that not all TIP projects can be executed. In the context of oversubscription of transportation construction funds, it becomes increasingly important to set priorities among TIP projects, to insure that the most urgent needs are met first.

In a very limited way, the TIP currently notes the highest priority projects by distinguishing an annual element from a 2-5 year element. According to a 1983 SubSignatory Committee agreement, when 75% of a project's design work has been completed and approved, the project should be placed in the annual element. Communities, however, need to know the relative importance of projects within their borders compared to others in their region before they make the commitment of funds for engineering design work.

Table 1 shows a comparison of the Urban Systems funding category of the TIP (excluding City of Boston projects) for 1981 and 1985. It shows the degree to which the TIP has in the past failed to indicate accurately which projects will be moved through the "pipeline" from preliminary design to advertisement for construction. Only 28.9% of all projects in the 1981 TIP (and only 42.7% of the projects in the 1981 annual element) had been advertised by 1985. At the same time, twenty-two projects actually moved backwards from the 1981 annual element to the 1985 2-5 year element. On occasion, projects which have reached or passed the 75% design stage are not advanced to the annual element. Furthermore, some projects fail to reach 75% design, even after several years in the 2-5 year element.

The failure of the TIP to reflect the status of projects is particularly problematic in light of the oversubscription of federal highway funds. Table 2 shows a comparison of the total cost of projects in various categories of the FY85 TIP with the federal funds available. (Funds may not be transfered between categories). Note that in the Urban Systems

Table 1

Comparison of '81 and '85 TIPs

for Urban Systems - Urbanized Area

Projects in:

Both '81 and '85	# of Projects	%
o in 2-5 '81, 2-5 '85	18	11.0
o in 2-5 '81, AE '85	3	1.8
o in AE '81, AE '85	9	5.5
o in AE '81, 2-5 '85	22	13.5
	52	31.8
In '81 not in '85		
o advertised	47	28.9
o dropped	20	12.3
o unaccounted for	17	10.4
	84	51.6
Not in '81, in '85		
o both 2-5 & AE	27	16.6
	163	100.0

TABLE 2

TIP Project Costs V Available Funds

Category	TIP project costs			Available	Difference	
	Annual	2-5 Year	Total	Funds	$	%
Consolidated Primary	19,178	140,075	159,254	264,921	105,668	66%
Rural Secondary	500	1,300	1,800	31,439	29,639	1646%
Urban System, Boston	5,300	24,500	29,800	20,200	-9,600	-32%
Urban Systems, Urbanized Area	20,808	64,943	85,751	47,200	-38,551	-45%
Bridge	30,050	128,989	159,048	230,038	70,990	45%
Interstate Transfer	14,734	67,999	82,733	88,404	5,671	7%

Note: All amounts are given in thousands of dollars

Boston Urbanized Area category, the cost of scheduled projects exceeds available funds by more than thirty-eight million dollars. This means that funds are not available for nearly half of the programmed projects. The discrepancy shows the importance of establishing project priorities.

When MDPW directs its district offices to work less on some projects and more on others, priorities are being set de facto. These priorities, however, are not made public nor is their basis or the process by which they are established.

The absence of a formal priority-setting process makes it difficult for communities to plan for future road improvements. It also raises the possibility that projects which, by virtue of the severity of the problems they address, should be undertaken with due haste, may be deferred in favor of less urgent projects. Finally, it leads to confusion about what distinguishes important projects: lacking an articulated set of criteria, communities, the MDPW and the public have no way of knowing whether a given roadway problem is severe enough to merit immediate attention.

When projects are selected for construction with no oversight or review by bodies outside MDPW, the influence of political considerations unrelated to the technical merits of the projects may assume a disproportional importance. In the absence of an understandable and open priority-setting process, there is no way of knowing whether, for example, a project is advanced so that the area in which it is located may receive its "share" of road work in highway funding. There is a legitimate role in highway programming for the expression of community concern through elected officials. But without an agreed-upon priority-setting procedure which incorporates as much objective technical analysis as is feasible, the political factor may be exaggerated.

Other states have adopted various methods of evaluating proposed road improvement projects for purposes of programming and priority-setting[1]. The Federal Highway Administration has indicated its support for setting priorities among TIP projects, and has gone so far as to predicate federal funding for roadway improvements on the use of a priority-setting procedure.

Study Organization

In this study, the variety of priority-setting techniques in general use is first examined. An outline follows of the types of data which are required for evaluating the relative importance of projects, and their availability at present. Against this background of experiences in priority-setting and the constraints which apply locally, the next section discusses practical options available for improving priority-setting procedures in the Boston MPO. Conclusions deal with the needs for planning and data collection which the study has revealed.

[1] See Seven Approaches to Highway Programming, FHWA Report # 4, June 1981.

Funding Categories

The purpose of setting priorities among projects is to determine which should be performed first. Funding levels for the different categories are determined independently, so a project in one category may be funded when a more important project in another category may not. The relevant group of projects which should be compared, then, is those in the same funding category, for those projects in a real sense compete with each other.

It is not necessary or appropriate, however, to set priorities for all funding categories. The Interstate category, for example, has only a few projects, mostly large-scale works such as the Central Artery depression or the reconstruction of the I-95/Route 128 interchange in Peabody. Priorities for these projects are determined at the highest executive and political levels in Washington. On the other hand, execution of projects in the Urban Systems, Boston category is at the discretion of the City of Boston, and so likewise that category does not require priority-setting at the state or regional level.

There are a number of categories, such as Pavement Marking, Railroad Crossings, etc., which in most years contain only a handful of projects. In the case of these categories, how a project compares with the two or three others with which it is grouped is of little importance, and it is not necessary to set priorities between them. Other small categories, such as Rural Secondary, should be subjected to a priority-setting procedure, because they may in other years contain considerably more projects.

Table 3 enumerates the thirteen funding categories, the number of projects in each in the FY85-89 TIP, the governmental level at which priorities are established, and whether priority-setting in a regional context is appropriate.

Definition of Need

The first step in determining which TIP projects are the most critical is to establish what constitutes a deficiency in an existing condition. The literature on road project programming generally refers to four broad and overlapping categories of concern: physical condition, safety, capacity and access.

The physical condition of a facility can be assessed in terms of age and date surfaced, pavement condition, certain geometric characteristics such as median and shoulder widths, and drainage. More than half of the projects in the major categories of recent TIPs have been for resurfacing. Such projects often result in the improvement of drainage and geometrics as an auxiliary benefit.

TABLE 3

TIP Funding Categories, 1985-1989 TIP

Category	# Projects	Total $	Funding Basis	Set Priorities?	Reason, if No
Interstate	7	$2,413,000,000	Federal	No	Few projects, federally planned
Interstate Resurfacing	15	74,415,000	Federal	No	Federally planned
Consolidated Primary	21	159,253,000	State	Yes	
Rural Secondary	3	1,800,000	State	Yes	
Urban Systems Boston	9	29,800,000	City	No	Locally planned
Urban Systems Boston Boston Urbanized Area	69	85,751,000	Regional	Yes	
Highway Bridge R & R	86	159,048,000	State	Yes	
Consolidated Primary (RRR)	2	5,700,000	State	No	Few projects, sufficient funds
Hazard Elimination	5	2,203,000	Regional	No	"
Pavement Marking	1	125,000	Regional	No	"
RR Crossings Construction	1	125,000	Regional	No	"
RR Crossings Protective Devices	1	150,000	Regional	No	"
Interstate Transfer	26	82,733,000	State	Yes	

Capacity deficiencies are as easily identified as physical problems, though they are usually more difficult to remedy. The obvious symptom of insufficient capacity is traffic congestion. Congestion can be measured and expressed in terms of volume/capacity ratios, levels of service, and vehicle delay. While seriously congested conditions exist at numerous locations throughout the metropolitan area, in many cases the problem is addressed less cost-effectively by physical improvements than by transportation system management measures such as contra-flow lanes and ridesharing. Still, for identified projects which have been proposed on the grounds of alleviating capacity deficiencies, it is important to assess levels of congestion for comparative purposes.

The safety of a given intersection or road segment is difficult to measure. The occurrence of one or two accidents over a period of a year or so may make a location stand out from the norm. Statistically, however, such an occurrence may not signify anything about the comparative safety of that location. Nonetheless, accident rates are crucial to the assessment of a project's urgency.

Access is used here as a general term referring to the construction of new roads. The need for access not already available can be expressed and measured in different ways: congestion on existing facilities, land development generating new traffic, etc. Very few TIP projects outside the Interstate and Primary funding categories have to do with new facilities.

The degree to which different locations suffer from deficiencies in any of the above categories is the subject of inquiry in a priority-setting study. A good priority-setting procedure would systematically take all of these aspects of a road's function into account.

PRIORITY-SETTING PROCEDURES

Many state departments of transportation and, within Massachusetts, a number of regional planning agencies have devised methods for setting priorities among the various projects listed in or proposed for the TIP. There are a wide range of procedures possible, from technical, data-intensive formulas for measuring the need for a project to informal comparison of projects by programming officials. What follows is a summary of the types of priority-setting procedures used.

Weighted Formula.

A project's priority depends on the needs which that project will meet, and the severity of those needs. Each of the criteria discussed - safety, road condition, and capacity - can be quantified. The relative importance of those criteria can be expressed by using a formula calibrated with weighted variables to represent criteria. The values of those variables can be a scalar abstraction of the severity of need. For a simple example, assume that a policy decision has been made that safety is twice as important as level of service and road condition. Assume, further, that safety can be measured in terms of accidents per million passenger miles of travel; that level of service is a direct function of volume/capacity ratio; and that road condition can be measured by DPW road inspectors. The first step would be to convert the measures to equivalent scales, such as between one and ten. It would then be easy to rank projects objectively by using the formula $R = 2\,AR + V/C + RC$ where R is the project rating, AR the accident rate, V/C the volume-capacity ratio, and RC the road condition. For each project the result would be a rating of between zero and forty "points," and projects could be compared on this basis.

The above example, of course, is extremely simplified. The weighted formula can be used in varying degrees of detail. In Arizona, a weighted formula is used which is quite simple, using only safety, road condition, service, environmental and socio-economic measures. Georgia, on the other hand, uses an elaborate formula which assigns weights to some thirty-four different variables (see table 4). In Minnesota, different formulae are used depending on the category of project, in recognition that the criteria for a bridge project and a resurfacing may be different. Figure 1 details the variety of criteria used.

Sufficiency Rating.

Another method of evaluating the relative importance of projects is a sufficiency rating. This procedure takes into account the same criteria as a weighted formula, but rather than combine them into a single numerical score, sufficiency rating involves setting standards of adequacy in the areas of safety, road condition and level of service. If a project site is judged deficient in any of these respects, the project is given a higher priority.

TABLE 4 - Example of Weighting Formula

Evaluating Parameters and Component Factors	*Weight Factor by Type of Improvement*					
	1	*2*	*3*	*4*	*5*	*6*
Need for improvement	(7.6)	(7.3)	(4.7)	(4.5)	(3.2)	(3.4)
Identified by transportation plans	8.8	8.4	4.1	3.4	1.5	2.2
Identified by state, regional, or local officials	7.2	7.2	5.0	5.1	2.5	2.2
Identified by department officials	8.1	7.8	6.6	7.0	5.2	3.6
Identified by community response or local opinions	6.3	5.9	3.1	2.5	3.4	5.6
Physical deficiency	(7.1)	(7.5)	(8.7)	(8.7)	(2.9)	(1.1)
Structural condition	7.1	7.5	8.7	8.7	2.9	1.1
Structural adequacy	7.1	7.5	8.7	8.7	2.9	1.1
Pavement condition	7.1	7.5	8.7	8.7	2.9	1.1
Pavement adequacy	7.1	7.5	8.7	8.7	2.9	1.1
Operational deficiency	(7.7)	(8.1)	(8.8)	(6.3)	(3.7)	(5.1)
Traffic volume	8.1	8.1	9.2	5.6	6.9	5.8
Volume/capacity ratio	8.2	8.3	9.0	6.9	2.0	4.4
Speed and delay	7.7	8.1	8.8	6.3	2.7	6.1
Roadway alignment and geometric	6.9	7.8	8.2	6.3	3.2	4.2
Safety deficiency	(7.2)	(8.0)	(8.7)	(9.1)	(8.0)	(9.6)
Accident experience	7.5	8.3	9.8	9.8	9.8	9.8
Accident potential	7.2	8.0	8.7	9.1	9.8	9.8
Roadway alignment and geometric	6.9	7.8	7.6	8.4	4.3	9.2
Continuity of travel	(7.7)	(7.3)	(2.3)	(3.1)	(0.9)	(1.5)
Existing highway network	7.6	6.9	1.7	2.8	0.6	1.8
Multimodal facilities	7.7	7.3	2.3	3.1	0.9	0.8
Other highway improvement projects	7.9	7.7	3.0	3.4	1.1	1.8
Benefit/cost ratio	(6.5)	(6.2)	(4.4)	(4.2)	(2.6)	(1.3)
Use benefit only	6.5	6.2	4.4	4.2	2.6	1.3
Economic aspects	(5.3)	(5.3)	(2.4)	(1.4)	—	—
Conformity with comprehensive plans	8.9	7.6	4.4	4.2	—	—
Impacts on land value and development	6.1	5.7	3.7	—	—	—
Impacts on tax base	6.0	5.3	3.9	2.8	—	—
Impacts on employment	4.2	3.8	—	—	—	—
Impacts on public services (utilities)	3.6	4.3	—	—	—	—
Social aspects	(6.5)	(5.6)	(0.8)	(0.9)	—	—
Displacement and relocations	6.6	4.3	—	—	—	—
Impacts on social patterns	7.5	6.2	—	—	—	—
Disruption to communities during construction	5.0	5.1	3.2	3.6	—	—
Preservation of historic, religious, and institutional sites	6.8	6.8	—	—	—	—
Environmental aspects	(7.3)	(6.5)	(2.2)	(4.1)	—	—
Aesthetics	6.8	6.0	2.7	6.2	—	—
Air pollution	6.8	6.5	—	—	—	—
Water pollution	7.8	6.6	4.5	7.0	—	—
Noise pollution	6.8	6.5	—	—	—	—
Physical resources	7.7	6.7	3.0	5.8	—	—
Biological resources	7.7	6.7	3.0	5.8	—	—

Notes: Type of improvement numbers stand for:

1. New construction
2. Reconstruction and major highway upgrading
3. Minor highway upgrading
4. Structures, new and replacement
5. Safety improvements
6. Traffic engineering improvements.

The means shown in parentheses are the final adjusted-weight factors for the evaluating parameters. That is, the sum of the weights for all component factors divided by the number of components.

Source: Seven Approaches to Highway Programming, USDOT, FHWA, June 1981

Figure 1

Minnesota Priority-Setting Procedure

Project Class	Technical Criteria and Weight
Resurfacing and Reconditioning	Condition Rating (70%) Cost-effectiveness (20%) Functional Class (10%)
Reconstruction and New Major Construction	Sufficiency Rating (35%) Cost-effectiveness (20%) Goods Movement (20%) Peak-Month Traffic (5%) Functional Class (20%)
Interstate	No fixed priority-ranking, criteria-based process; resources directed toward system preservation, gap or stage completion, and overall completion.
Bridge replacement	Structural Adequacy and Safety (50%) Serviceability (functional obsolescence) (25%) Essentially for Public Use (25%)

Source: Humphrey, T.F., Evaluation Criteria and Priority Setting for State Highway Programs, NCHRP #84, Nov. 1981, p.26.

In comparison to the weighted formula, the sufficiency rating is thus more specific in identifying the problem which a project addresses. With a sufficiency rating, there is no danger that, for example, an unacceptable road condition will be "out-weighed" by an unblemished accident record. On the other hand, if a project site was nearly, but not quite, deficient in all three areas, it would be given a lower priority than one where the level of service was barely deficient but the other criteria indicated a satisfactory condition.

A very comprehensive and adaptable version of a sufficiency rating is one devised by the COMSIS Corporation and published and endorsed by FHWA.[1] The basis of the procedure is the worksheet shown in Figure 2. The appraisal process starts with the collection of the data required in lines B-1 through B-23. The sufficiency ratings are then computed and entered on the next eight lines, and inadequate ratings noted as critical deficiencies in section C. "A road section," the manual says, "is critically deficient if one or more of the eight ratings is below the 'critical level' for that rating, as established by the programming committee."

One way to resolve the difference between the two methods is to combine them. Once the different criteria have been analyzed independently and rated in terms of sufficiency or insufficiency, they can be weighted according to their relative importance. For example, if, as above, it were deemed that safety is more important than road condition or level of service, and that a deficiency in one of the latter two categories is not as serious as a deficiency in safety, weighting could be performed as above, with a project's score being expressed in terms of "percent sufficient." A project site deficient in road condition but sufficient in safety and service would be 75% sufficient, while one deficient in safety alone would be only 50% sufficient.

Expert Committee

The references above to policy decisions regarding the relative importance of safety, level of service and road condition indicate that no technical priority-setting procedure can be instituted which does away with the need for informed judgements. As Thomas F. Humphrey, of the Center for Transportation Studies at MIT, says,

> The nonquantifiable factors involved may collectively out-weigh the importance of technical analysis. This is not meant to imply that the nonquantifiables make the quantifiables unimportant, but the technician must recognize that, for example, a number ranking obtained from a technical sufficiency rating is not necessarily the final one. The technician must be sensitive to the fact that the expenditure of state funds for any program is part of an overall political process that must consider a great deal of information and pressure.[2]

1 "Programming Projects," USDOT, 1980

2 "Evaluation Criteria and Priority Setting for State Highway Programs," National Cooperative Highway Research Program #84, Transportation Research Board.

FIGURE 2

Section A Identification

A-1 Municipality
Type _____ Name _____
A-2 Section Number _____
A-3 Route Number _____
A-4 Street Name _____
A-5 From _____
A-6 To _____
A-7 Length _____
A-8 Present Jurisdiction _____
A-9 Federal-aid System _____
A-10 Functional Class _____
A-11 Structure Numbers ___ ___ ___

Section B Analysis

B-1 Environment Urban ___ Rural ___
B-2 Area Development
Res. _____ Comm. _____ Ind. _____
Farm. _____ Vacant _____
B-3 Surface Type _____
B-4 No. of Lanes _____
B-5 Divided Yes __ No __
B-6 Right of Way Width _____
B-7 Surface Width _____
B-8 Shoulder Widths L ____ R ____
B-9 Median Width _____
B-10 Traffic Signals Yes ___ No ___
_____ _____
B-11 Sidewalks L ____ R ____
B-12 Curbing L ____ R ____
B-13 Drainage Ditches _____
Storm Sewers _____ Comb. Sewers ___
B-14 Parking L_____ R _____
B-15 Existing Traffic _____
B-16 Future Traffic _____
B-17 Average Speeds
Peak Hour ___ Off Peak Hour ___
B-18 Fatal Traffic Accidents _____
B-19 Fatal Traffic Accident Rate _____
B-20 Total Traffic Accidents _____
B-21 Total Traffic Accident Rate _____
B-22 Date Constr. or Reconstr. _____
B-23 Date Resurfaced _____
B-24 Structural Adequacy Rating _____
B-25 Drainage Rating _____
B-26 Surface Width Rating _____
B-27 Shoulder Width Rating _____
B-28 Fatal Traffic Accident Rating ____
B-29 Total Traffic Accident Rating ____
B-30 Peak Hour Speed Rating _____
B-31 Off-Peak Hour Speed Rating _____

Section C Deficiencies

C-1 Critical Deficiencies
Structural _____ Surface Width _____ Fatal Accidents _____
Drainage _____ Shoulder Width _____ Total Accidents _____
Peak Hour Speed _____ Off Peak Hour Speed _____

Section D Improvement Cost

D-1 Type of Improvement

Traffic Operations
Traffic Signals _____
Turn Controls _____
Parking Controls _____
One-way Movement Controls _____
Unbalanced Flow Controls _____
Lane Use Controls _____
Traffic Channelization _____
Access Control _____
Other _____

Construction
Resurface _____
Reconstruct _____
Drainage _____
Widen _____
New Road _____
Other _____

D-2 Cost of Improvement _____

SAMPLE ARTERIAL AND COLLECTOR ROADWAY APPRAISAL WORKSHEET

Minnesota is a good example of the combination of technical with non-technical procedures. According to Humphrey, "The Minnesota DOT develops its highway program in recognition of the fact that evaluation criteria frequently are difficult to define, that they cannot easily be quantified, and that many decisions must be made in qualitative terms... technical criteria are used only to assist in project selection; other factors... are frequently of equal or greater importance..." At some point in the priority-setting process, the information collected and the objective comparisons generated regarding TIP projects must be used in conjunction with policy judgements which technical formulae cannot embody.

For this reason, and also because of the problems that exist now and may persist with collecting project data, priority-setting may require oversight by an expert committee. The duties of this committee could be defined in a number of ways. The committee might be responsible simply for supplying missing data and translating changes in policy into adjustments in the formula weighting factors. On the other hand, it could be charged with attaching the final priorities to projects, basing their decisions in part on the technical procedure, but also exercising informed judgement and administrative discretion. The advantages of a priority-setting procedure involving an expert committee are, first, that both technical and non-technical issues could be taken into account; second, that the committee could, in many cases, base their decisions on available information, whereas a formula-based procedure might not function if any datum were missing; third, that the existence of the committee, and its members' interest in making sound, informed decisions, would itself provide an impetus for the collection of relevant project data.

As with any priority-setting procedure, decision by expert committee would not guarantee that TIP projects would be advertised in any set order. As always, the actual progress of projects through the pipeline will depend to some degree on factors beyond the control of policy-makers, such as available funding, MDPW manpower constraints, communities' completion of design work and public acceptance of the project. The priority-setting process functions only to label certain projects as more important than others, all practical considerations being equal.

Current Practice in the Boston Region

At present there are no priorities attached to the projects contained in the Boston MPO's TIP. The TIP is compiled form the previous year's document (as amended), along with new projects proposed by MDPW, MBTA, MAPC and the communities. The draft TIP is prepared by CTPS using information from the Project Information System maintained by the Capital Expenditures and Programming Office (CEPO) of MDPW. The draft is circulated among the MPO agencies; MAPC solicits community review of projects. The Joint Regional Transportation Committee reviews the TIP before final approval by the MPO.

Although priorities are not explicitly given to TIP projects, obviously there is a process by which projects are selected for engineering design and, ultimately, for advertising and construction. The system apparently is an informal one, coordinated within CEPO on the basis of a variety of types of information. The level of community concern and support for a project is an important factor; it can be expressed by elected officials, by local governments through their allocation of resources to project engineering, or by direct communications by citizens and community groups. CEPO also consults the MDPW district offices regarding the importance and practical circumstances of projects.

In practice, the fate of individual projects depends on a number of circumstances, some of which are not directly controllable by either community or state officials. The fact that transportation funds expire after three years means that some projects must be advertised expeditiously or else the federal money for them will be lost or will have to be diverted to other, perhaps lower priority projects. Which projects benefit from this compressed attention is a function not of their individual features but of how close they are to being ready to advertise when the funding cycle draws to a close. The MDPW's manpower constraints also affect project scheduling. A major project may absorb staff time that otherwise could be spent bringing smaller projects to completion, because it is more efficient to concentrate the effort to get the big project out of the way. The priority-setting process may also be affected by considerations of geographic equity which are not related to the severity of conditions pertaining at specific project sites. Ultimately, the disposition of highway funds is at the discretion of the executive branch of government.

DATA REQUIREMENTS AND AVAILABILITY

Whatever the criteria used in making decisions about which projects will receive priority treatment in design, engineering and advertising, it is clear that there is at present in the Boston region no systematic use of information pertaining to the conditions and characteristics discussed above under "Definition of Need". In fact, most of this information is not currently available in any handy form. It is scattered in various locations and often is incomplete.

Data regarding the dimensions of roadways is the easiest to obtain. The Road Inventory File contains the pavement width, the width of shoulders, medians and sidewalks, if such exist, and the number of lanes of every public way in the state. Such information can be of use in determining the capacity of road segments. Furthermore, shoulders and/or sidewalks can generally be considered to improve a roadway's levels of safety and service, so to this limited extent projects providing those amenities would deserve a higher priority. One piece of geometric data which the Road Inventory File does not contain is right-of-way width, an important factor in determining the feasibility of such improvements as road widening and addition of turning lanes.

Structural information, a component of roadway condition assessment, is also available from the Road Inventory File. The type of paving material is listed, as is the age of the pavement.

Information regarding the dimensions and composition of street pavement, while valuable in determining capacity, does not help assess actual volumes of traffic. Current average daily traffic volumes are perhaps the single most important variable in determining both how important a facility is in terms of the number of people served and how well the facility functions. Yet that information is available only for a relatively small percentage of TIP projects. The problem is that while traffic counts have been taken at one time for a large proportion of the road segments in the region, no data base has been established which would make available the most current counts for any given segment. More specifically, there has been no systematic effort to take counts for each TIP project.

The same can be said of accident statistics, an extremely important facet of the project information necessary to evaluate relative importance. While a detailed listing of motor vehicle accident reports is available from MDPW's Bureau of Traffic Operations, it is organized in such a way that accidents at any one location may be listed in three or four different places. To extract from the listing the number of accidents occurring in each of 250 or more locations would be an enormous research task. Until accident data for each TIP project location is recorded systematically in an accessible place and form, it will be impossible to make informed comparative judgements about the safety performance of roadway segments and intersections.

Many TIP projects are researched in considerable depth in the context of a functional design report, an assessment of site conditions which is required for projects which are designed by private consultants under contract to the MDPW. The functional design report is mandated by the MDPW chief engineer; requirements for its contents were set out in a letter to all district highway and design engineers in a letter of July 12, 1977. (See Appendix B).

If functional design reports were prepared for each TIP highway project, and if they were comprehensive in their description of site conditions, they would provide much if not most of the information necessary for setting priorities among projects. However, functional design reports are not prepared for those projects which MDPW designs in-house, which is a substantial number. When a sample of 1985 TIP projects was selected for the purpose of testing how much information relevant to priority setting could be collected, functional design reports had been prepared for only three of sixteen. Furthermore, the reports are inconsistent in the level of detail they provide. The discussion of safety conditions, for example, does not always include meaningful accident rates. (Table 5 shows the results of the sample of TIP projects.) As a means of providing a comprehensive set of statistics pertaining to the safety, capacity and level of service of a road section, the functional design reports are inadequate in their present form.

The data which decision-makers need to inform their opinions about priorities is not currently available to them in usable form. Consequently, the judgement being made about which projects should be moved forward more quickly than others cannot rely on the best objective evidence for support. In order for a priority-setting procedure to be meaningful, there must be grounds for comparison between projects. Only when basic information about safety, capacity, volume and condition is available will sound decisions about priorities be possible.

TABLE 5 - Information Available about Road Projects

Sample randomly chosen from 1985-1989 TIP

own	Project	%	AE	RIF	FDR, EIR	ST	#L	ROW	SW	S&M	Sig	S&C	Dr.	P	ADT	FT	AS	Acc	FA
anvers	Rte 195, 01	0	X	X		X	X		X	X		X							
ilmington	Rte 129, 01	25		X		X	X		X	X		X							
ramingham	Rte 30, 03	90	X	X	X	X	X		X	X		X			X				
evere	Rte 60, 03	0		X		X	X		X	X		X							
verly	Brimbal Ave, 01	0		X		X	X		X	X		X							
mbridge	Harvard Sq., 01	0		X		X	X		X	X		X							
lbrook	5 locations, 01	90	X																
rlborough	3 locations, 01	0		X		X	X		X	X		X							
wton	Grove St., 02	0		X		X	X		X	X		X							
oneham	Montvale Ave, 01	0		X		X	X		X	X		X							
nthrop	Veterans Rd, 01	0		X		X	X		X	X		X							
ivers	Rte 128, 03	0	X	X		X	X		X	X		X							
ton	Blue Hill Ave, 02	0		X															
bridge	Lechmere Phase III	85		X	X	X	X		X	X		X			X	X			
ton	West Newton Sq., 01	75	X	X	X	X	X		X	X		X		X	X	X		X	

y: RIF = Road Inventory File; FDR = Functional Design Report; EIR = Environmental Impact Report;
ST = Surface Type; #L = Number of Lanes; ROW = Right-of-Way; SW = Surface Width; S & M = Shoulders and Median; Sig = Signalization; S & C = Sidewalks and Curbs; Dr. = Drainage; P = Parking
ADT = Average Daily Traffic; FT = Future Traffic; AS = Average Speed; Acc = Accidents;
FA = Fatal Accidents.

PRACTICAL OPTIONS

There is no intent here to propose a system which stipulates precisely which projects in each major funding category will be let out to contract first. Funding requirements regarding completion of engineering design, environmental reviews, and conformance with adopted plans, as well as the unavailable exigencies of the MDPW's personnel assignments scheduling, make it impossible to guarantee that any one project will be executed before another. For this reason, and also for others having to do with the difficulty of comparing very different types of projects, it is not advisable to rank projects numerically in order of their priority. Instead, what will be considered are procedures for attaching to projects a measure of relative importance. Simply to devise and implement a procedure for designating projects as high, medium or low priority would be a substantial and sufficient accomplishment.

Data Collection.

It is clear that no systematic priority-setting procedure can operate in the absence of comprehensive project data. A large amount of information could be collected about each project for the purposes of input into a weighted formula, including such items as shoulder width, drainage and pavement type. The availability of such data is desirable, but given the current state of affairs and the constraints on MDPW manpower, it may be more feasible to scale down data requirements and concentrate on securing the most basic and vital facts about each project. These would include, at a minimum: average daily and peak hour traffic, capacity, pavement condition, and accident rates.

The problem of making this information available to the priority-setting process and committee is largely one of arranging for its collection and recording. At present there is no system which does this, except for the functional design reports whose drawbacks are discussed above. However, if only the minimum project information were required, a few relatively minor changes in present MDPW procedures, as follows, would accomplish the task of data collection.

1. The requirements for functional design reports could be broadened to include all the basic priority-setting criteria. This would not be difficult: functional design reports already include traffic volumes, and capacity calculations can be based on geometrics available in the Road Inventory File. Pavement conditions pose more of a problem, since a pavement assessment methodology would have to be selected, disseminated and used uniformly. A number of pavement rating methods are available.[1]

[1] See, for example, "A Pavement Rating System for Low-Volume Asphalt Roads", The Asphalt Institute, No. 169 (IS-169), November, 1977; Hartgen, David T. "The Pavement Condition of NY Highways: 1983: DOT, December 10, 1983; Hartgen, David T. & Neveu, Alfred J. "Perception of the Infrastructure: The Application of Behavioral Concepts to Evaluation of Highway Condition", NY DOT, July, 19[illegible]

Meaningful accident rates are hard to derive, because accidents are rare enough to be statistically difficult to draw conclusions about. In the procedure endorsed by FHWA, for instance, for a road segment less than one mile long having less than 34,000 average daily traffic, a single traffic fatality in any year would produce a fatal accident rating of zero, apparently a clear indication of a serious deficiency in a critical criterion. If the next year there was no fatality recorded along that road segment, the "problem" would disappear. Statistically, of course, both findings are unlikely to be significant. What is needed to accurately assess the safety of a road segment (as opposed to an intersection) is a longer-term record of accidents, covering perhaps five years. This will be difficult to compile prior to putting a project on the TIP.

For projects about which a functional design report is not prepared, the compilation of data could be made the responsibility of the project engineer. This would be the only point at which the priority-setting process would require extra work by MDPW engineers. Once the procedure was instituted, the routine collection of basic project information should not be an imposition.

2. The Project Management System, which currently contains mostly information about the status of TIP projects (percent design completion, funding category, engineer responsible, etc.) could be expanded to include relevant information about pre-existing conditions at the project site. The PMS would thus become the repository for the project data required for priority-setting. The changes necessary in the PMS would be minor, involving only the enlargement of each project record's existing field.

The consolidation of project information in the PMS might be facilitated by the revamping of MDPW's data management system, a process which is beginning currently and which will take place over the next five years under the direction of a consultant yet to be selected. It might be possible, for example, to allow project engineers access via computer terminal both to a central bank of recorded traffic counts and to the PMS, where they could easily update project files as information becomes available. It is recommended that the requirements of the priority-setting process be made known to the designers of MDPW's new data management system.

Comparing Projects.

Another practical problem is that of comparing different types of projects. Most TIP projects are for the reconstruction of road segments. This is the type of project generally referred to in this report in discussions of accident rates, volume/capacity ratios, etc. A substantial minority of projects, however, are different: they involve an intersection instead of a road segment, or a group of unconnected segments. None of the procedures examined is set up to compare these different types of project.

One solution to this problem would be to subdivide each funding category into resurfacing/reconstruction, traffic and construction/widening. Priorities could then be set for each subcategory separately. A subjective judgement would still have to be made about where to draw the line between high, medium and low priorities for each of the subcategories in relation to each other. It might also be beneficial to require that projects consisting of multiple sites be broken up into single-site parts. While this might facilitate priority-setting, however, it could be disadvantageous from the perspective of construction and traffic management. Often a multiple-site project is proposed to minimize total disruption of traffic flow and to promote efficiency in construction.

Priority-Setting Committee.

The preceding discussion indicates that no priority-setting procedure will operate automatically, without some degree of intervention by decision-makers. Thus there is no clear line between the options of priority-setting by technical procedure or by expert committee. Some group, whether technicians or a priority-setting committee, will be responsible for attaching priorities to projects. Informed critical judgement would be necessary to operate even the most detailed technical procedure. By the same token, even a committee empowered to set priorities based on their expert opinions would need to use a method of comparison based on available objective measures. A priority-setting committee of some sort would be required no matter what procedure was used. In what follows, use of the term priority-setting committee does not imply prejudice in favor of putting priority-setting in the hands of experts.

The composition of a priority-setting committee is an important matter. At issue are the degree to which MDPW permits outsiders to participate in setting the order of performing highway projects, the role of public participation in project programming, the relative virtues of technical evaluation and informed common sense, and the relationship of MAPC to the other MPO agencies. A number of options have been suggested, as follows.

1) The MDPW Project Review Committee could simply expand its present role and begin attaching priorities to TIP projects. The PRC, which is composed of MDPW staff engineers, is well informed, both technically and about the current condition of the region's road system. The advantages of this option would be that the PRC would be familiar with the projects and would be fully competent to apply any priority-setting procedure based on evaluation of physical and statistical conditions. The disadvantages would be that the PRC might not be sensitive to the concerns of local residents or to the importance of non-transportation considerations such as the potential effect of a project on local economic development or the impact

of construction on a residential neighborhood. Also, if the PRC were responsible for setting priorities it might be perceived as not independent enough from the executive offices of the MDPW to insure complete objectivity. Furthermore, since the PRC's role as now defined is to confer the official status of "project," this approach would risk the conflation of programing and priority-setting.

2) A committee of MPO designees, similar to and perhaps selected by the SubSignatory Committee, could set TIP priorities. Such a body would represent all aspects of the region's public transportation structure, including, through MAPC, community interests. MDPW designees would be familiar with TIP projects, while MAPC designees could look at the TIP from both a regional and a local point of view. The roles of the MBTA, MBTA Advisory Board, and MassPort in the review of highway priorities would, presumably, be minor; they could, however, provide balance and objectivity.

3) Priority-setting could be put in the hands of the MAPC Transportation TAC, or a subcommittee thereof. The TAC is composed of MAPC members (including Gubernatorial and agency appointees), MDPW and MBTA officials, and other interested, qualified people who serve with council approval. It functions as an advisory committee to the MAPC Executive Committee.

   If the TAC itself were designated the priority-setting committee, one result might be a precipitate rise in the TAC membership. Since the TAC is open to any council member and, in practice, to outsiders as well, the importance of project-priority-setting could be expected to attract new membership.

   The TAC's role as an advisor to the Executive Committee does not encompass the new authority and responsibility that would inhere in setting priorities for highway projects, unless those priorities were to be presented merely as MAPC recommendations. The TAC could perhaps be vested by the MPO with authority over and above that contained in its role as an MAPC advisory committee. In that case the MPO could prescribe membership regulations for the TAC in its priority-setting role. The TAC would actually function as two distinct committees, one with its present role and the other with the new responsibilities and procedures related to priority-setting.

4) The Joint Regional Transportation Committee, or a JRTC subcommittee, could be designated the priority-setting committee. The JRTC is made up of representatives from the MPO agencies, citizen advisory and advocacy groups, professional organizations, and other state agencies. Its membership is a cross-section of those knowledgeable about and concerned with transportation issues. It already has a formal structure governing membership and procedures, and its endorsement is require for amendments to the TIP.

5) In addition to the options listed above, others could be created by considering a bipartite structure in which a technical committee generates priority assignments and a lay committee reviews them. For example, the MDPW Project Review Committee could assign priorities, while the MAPC Transportation TAC or some other MAPC subcommittee could perform the review. This option would avoid the problem of a committee which is either too technically or too politically grounded, by allowing both elements to play a role.

Ultimately, the decision as to who would comprise the expert committee would depend on what specific problems priority-setting was intended to address. If the primary problem is perceived to be that some important projects get stuck in the pipeline or even move backwards, and the desired result is that high-priority projects are guaranteed to be moved forward with due speed, it would be wise to include on the priority-setting committee both people sensitive to community needs, such as CTPS or MAPC staff, and members of MDPW who are aware of the constraints which may hinder the advancement of certain projects. If the concern has more to do simply with opening up the process so that the way in which priorities are set is clear, the Project Review Committee could set priorities. The public should be invited to attend priority-setting meetings.

The expert committee would rank TIP projects on the basis of their own understanding of traffic management, transportation planning, and the needs of the communities and the region as a whole. No formal priority-setting procedure would be prescribed for the committee, beyond perhaps guidelines as to how the members' individual judgements should be expressed, mediated and resolved into a committee endorsement.

As with committees generally, the options regarding decision-making involve either consensus or majority rule. Priority-setting by committee consensus would require considerable discussion and reevaluation, as well as a basic agreement among members as to the criteria of urgency. While such a process would be time-consuming, it would have the advantage of stimulating discussion of planning principles and, ultimately, of forging a shared appreciation among the various constituencies represented on the committee of the need to balance competing transportation funding demands region-wide.

If the committee were to function by voting on the priority to be attached to projects, there are a number of ways the process could be handled. The simplest would be for members individually to term each project as having a high, medium or low priority; whatever ranking receiving the most votes would be the priority attached to the project. Such a process would be quick and easy to administer, not even requiring the committee to meet. The danger is that preconceived notions would not be challenged, and that votes would fall into a pattern reflecting the interests and backgrounds of the committee members. One way of partially addressing this objection

would be a system like that in use in Georgia. There committee members rank projects in a two-phase process, first on the basis of their individual judgements and a second time after seeing the results of the first vote. The assumption is that weakly held opinions will move toward the mean when reevaluated and that strongly held opinions are the most valid. In any case, if a majority-rule process for setting project priorities were adopted, some arrangement for consultation and review would be necessary in order to make the process meaningful.

CONCLUSIONS

The facts of the comparison between TIPs from 1981 and 1985 demonstrate that project priorities are not being articulated clearly or followed. Even without these findings, however, the argument for priority-setting stands on fundamental principles of planning and organizational management. The annual element, which contains the projects slated for advertising in the current fiscal year, is filled, in theory, with projects selected from the previous year's 2-5 year element. Only approximately one in four projects in the 2-5 year element is advanced into the annual element in any given year. The 2-5 year element contains hundreds of projects, many of which will not be advanced into the annual element for years, if at all. Not to identify which projects in the 2-5 year element have higher and lower priority is to ignore the need for continuity and predictability in both local and state transportation planning.

In order for any of the priority-setting procedures discussed here to be implemented, a data collection system must be established which will make it possible to compare projects objectively. To reiterate the points made above:

- Data must be gathered regarding the safety, capacity, and condition of project sites;
- Functional design reports should contain such data, and either the proponents or project engineers should supply it when functional design reports are not prepared;
- The Project Management System should be the repository for the data.

A priority-setting procedure can only be meaningful in the context of a long-range Transportation Plan. Decisions regarding, for instance, how heavily to weight highway capacity improvements vis a vis new access must be based on official policy. Without it, the judgements of priority-setters would be unnecessarily subjective.

The question of who should be responsible for the priority-setting procedure is also related to the procedure's role in the planning process. Decisions are often made on the basis of other factors, such as the concern as well as considerations of geographical equity and economic development of the affected community, as expressed by its elected representatives. The extent to which this sort of influence, as well as considerations of geographic equity and economic development, are accepted as legitimate will in part determine the makeup of the priority-setting committee.

Each of the priority-setting techniques discussed here would require considerable time and effort to set up, particularly for the institution of a data-collecting system. This is a difficult problem to collect the required data, even the minimal amount proposed above, about each of the 116 projects currently in the three major categories (Consolidated Primary, Urban Systems Boston Area and Interstate Transfer) alone would require somewhere in the neighborhood for three to five weeks labor. While it would be relatively easy to require only that all new projects be accompanied with the necessary data, it would be many years before all the existing projects were removed from the TIP; and until all TIP projects had the data, comparisons would not be possible.

It might be necessary, under these circumstances, to adopt an interim procedure for use until the new priority-setting procedure is operable. The most obvious approach would be to appoint an expert committee similar to that discussed above. The major difference would be that an interim committee would be expected to make judgements about priorities based on often incomplete project information. For this reason, an interim committee would need to be composed of people knowledgeable in their own right about road conditions in the region.

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APPENDIX A

The Commonwealth of Massachusetts

Executive Office of Transportation and Construction

Department of Public Works

Office of the Commissioner

100 Nashua Street, Boston 02114

September 5, 1984

Mr. Nicholas F. Tangney, Chairman
Joint Transportation Planning Group
SRPEDD
25 Barnum St.
Taunton, Massachussetts

Dear Mr. Tangney:

In response to your August 15, 1984 letter concerning the reconstruction of Old Westport Road in Westport and Dartmouth as a Federally Aided Urban System Project, please be advised that the Department at the present time has a backlog of projects in design whose dollar value far exceeds the anticipated Federal level of funding over the next several years.

The Department has recently published a list of projects to be designed over the next five years utilizing expected availability of Federal funds. This was done in order to provide for more efficient use of our scarce supply of engineers by concentrating their efforts on those projects having a reasonable chance of being funded. It is expected that the five year list will be updated annually at the beginning of each new Federal Fiscal Year by deleting those projects that have been advertised and adding new projects.

Please be assured that your project will be given every consideration at the time of our first update in the first quarter of the new Federal Fiscal Year beginning this October 1st.

Very truly yours,

Robert T. Tierney

ROBERT T. TIERNEY
COMMISSIONER

WVT/vd

S.R.P.E.D.D.

SEP -7 1984

RECEIVED